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EPAct Program Update for Chet France

Status and Budget

February 19, 2008

Status of Testing and Fuel Blending

- Phase 1 testing complete
  - 75°F testing of 19 vehicles on 3 fuels (E0, E10, E15)
- Interim FTP-cycle testing complete
  - 75°F testing of 6 vehicles on 3 fuels (E0, E10, E15)
- Phase 2 testing complete
  - 50°F testing of 19 vehicles on 3 fuels (E0, E10, E15)
- Phase 3 testing expected to begin next week
  - 75°F testing of 10? (originally19) vehicles on 27 fuels (E0, E10, E15, E20)
- Test fuel development being done by Haltermann and ASD
  - EPA defines fuel recipes
  - Haltermann prepares hand blends, bulk blends and performs fuel analyses
- 22 of the 28 fuels needed in Phase 3 have been blended in bulk
  - 13 have been delivered to SWRI

Budget Considerations Going Forward

	Program or Project	Cost	Cumulative Cost	Difference of Total From the Original Estimate of $4,200,000	
ORIGINAL PROGRAM	Original EPAct Program Budget	$ 4,200,000	-	-	-
	EPAct Program, February 2009 Cost Estimate				
	Fuel Cost Adjustment				
ADDITIONAL PROJECTS	FTP Testing (Partially Competed)				
	EFM Resolution (Completed)				
	Miscellaneous				
	Blending of Two CRC Fuels				
	EmissionTesting of Two CRC Fuels				
		Grand Total >>>>	$ 6,479,200	$ 2,279,200	54.3%

Ex. 4 - CBI

Budget Considerations Going Forward (Cont'd)

- Original program cost estimate: $4,200,000
- Cost overrun wrt the original scope of program: Ex. 4 - CBI
- Cost overrun including additional projects: Ex. 4 - CBI
- Funds spent or incurred as of Feb. 19, 2009: Ex. 4 - CBI
- Funds "remaining" in LD EPAct budget as of Feb. 19, 2009: Ex. 4 - CBI
- Estimated cost of Phase 3: Ex. 4 - CBI
- Estimated cost of testing 2 CRC fuels in Phase 3: $ Ex. 4 - CBI
- New funds needed to get us through the end of fiscal year: $ Ex. 4 - CBI

Causes of Cost Overrun

- Unrealistically low original cost estimates by SWRI
  - Underestimation of base program cost : Ex. 4 - CBI
    - On January 7, 2009, SWRI was estimating base program cost overrun by 10% vs. 36.4 % on Feb. 5, 2009
    - Unexpectedly high cost of "coming up to speed": Ex. 4 - CBI
    - Additional checkout tests to resolve HC analyzer saturation and secondary dilution ratio issues in Phase 2: Ex. 4 - CBI
    - Higher than originally estimated test replication rate (+6%): Ex. 4 - CBI
- Fuel cost increase (modified fuel development protocol): Ex. 4 - CBI
- Blending of two CRC fuels: $55,000
- Additional tasks:
  - EFM resolution: Ex. 4 - CBI
  - Fuel matrix redesign: Ex. 4 - CBI
  - FTP testing: Ex. 4 - CBI

Program execution problems:

- Inadequate temperature control in Phase 2 of the program
- Fuels blended for Phases 1 and 2 contained undesireable components

Options to Reduce Cost

- Delay testing of CRC fuels: $195,000
- Reduce the number of test fuels
  - Reduction of the number of fuels by 1-2 would drop the G-efficiency of emission models below the minimum acceptable limit of 50%
  - The emphasis of this program is on fuels, not vehicles
- Reduce the number test vehicles
  - Reduction of the number of vehicles from 19 to 15 doubles the probability of getting a non-significant result in emission models. The power of the statistical test of 0.80 is the lowest acceptable in std practice (0.95 was used in AutoOil)
    - We are working with DOE on vehicle selection
  - Reducing the number of test replicates from 2 to 1 has an even stronger impact
- Eliminate continuous THC, NOx…. measurements in raw exhaust
  - Would make critical types of information unavailable
  - Minimal savings
- Reduce the scope of exhaust HC speciation
  - The cost of HC and alcohol/carbonyl speciation: **Ex. 4 - CBI**
  - Data necessary for AQ modeling and toxic emission factors
    - Phase I and II data not adequate due to fuel blending problems

Options to Reduce Cost (Cont'd)

- Work with SWRI to reduce program cost
  - Discussions between Chet and Bruce Bykowski (Vice President; Engine, Emissions and Vehicle Research)

- Request additional DOE support

Back-up Slides

Revised EPAct Fuel Matrix

Phase 3
Base Program (EPA)
(Fuels 1-16) →

Phases 1 and 2
RFS 2 Subset (EPA/DOE)
(Fuels 17-19) →

Phase 3
Additional Fuels (DOE)
(Fuels 20-29) →

E85 (DOE) →

CRC Additional Fuels →

Fuel #	T50 °F	T90 °F	ETOH %	RVP psi	ARO %
1	150	300	10	10	15
2	240	340	0	10	15
3	220	300	10	7	15
4	220	340	10	10	15
5	240	300	0	7	40
6	190	340	10	7	15
7	190	300	0	7	15
8	220	300	0	10	15
9	190	340	0	10	40
10	220	340	10	7	40
11	190	300	10	10	40
12	150	340	10	10	40
13	220	340	0	7	40
14	190	340	0	7	15
15	190	300	0	10	40
16	220	300	10	7	40
17	215	325	0	9	30
18	202	325	10	9	25
19	195	325	15	9	23
20	160	300	20	7	15
21	160	300	20	7	40
22	160	300	20	10	15
23	160	340	20	7	15
24	160	340	20	10	15
25	160	340	20	10	40
26	150	340	15	10	40
27	190	340	15	7	15
28	190	300	15	7	40
29	TBD	TBD	85	TBD	TBD
30	150	325	10	10	40
31	160	325	20	10	15

Revised Fuels

Light Duty Exhaust Program Summary

- EPA/DOE collaboration
- Objective: Establish effects of RVP,T50,T90, aromatic content and EtOH on exhaust emissions from Tier 2 vehicles
- Fuel matrix includes 29 fuels + 2 added by CRC = total of 31
- Test Program Design
  - Phase 1: RFS 2 Pilot at 75°F
    - 3 fuels (E0, E10 and E15) tested in 19 vehicles
    - Test results to be available for RFS 2 NPRM
  - Phase 2: RFS 2 Pilot at 50°F
    - Same as Phase 1, except temperature
  - Phase 3: Main Program
    - 27 fuels tested in 19 Tier 2 vehicles, E85 tested in 4 FFVs
- LA92 test cycle used throughout the program
- Species measured: Regulated emissions, CO_2, NO_2, VOCs, ethanol, carbonyl compounds
  - N_2O, NH_3 and HCN by FTIR
  - Some PM and SVOC speciation

Measured Species

- Bag (phase) level and composite emissions of THC, NMHC, NMOG, CO, CO_2, NOx, NO_2, ethanol and PM
- Bag (phase) level speciated volatile organic compounds (VOCs)
  - Over 200 compounds, incl. alcohols and carbonyls
- Continuous and integrated by bag (phase) emissions of the following species in raw exhaust:
  - THC, NMHC, CO, CO_2, NOx
  - N_2O, NH_3 and HCN by FTIR for a subset of tests
- Semi-volatile and high molecular weight VOC and PM measured in Phases 1 and 2 only

Projected Schedule Going Forward

- Launch of Phase 3 testing: Mid-February 2009
- Completion of Phase 3 testing: Early December 2009
- Reporting: December 2009 – mid-March 2010

		JAN 2009				FEB 2009				MAR 2009					APR 2009				MAY 2009				JUN 2009					JUL 2009				AUG 2009					SEP 2009				OCT 2009				NOV 2009					DEC 2009			
		5	12	19	26	2	9	16	23	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28
Phase 1[a]	14 weeks																																																				
50F setup	3 weeks																																																				
Phase 2[b]	9 weeks	4	5	6	7	8	9																																													
50F teardown	2 weeks																																																				
Phase 3[a]	26 weeks							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26																						
NREL fuels[a]	17 weeks																																	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
CRC fuels	4 weeks																																																		1	2	3
NREL high emitter	2 weeks																																																			
draft final report	6 weeks																																																		1	2	3
EPA/NREL review	4 weeks																																																			
final report	4 weeks																																																				

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